

English



DLCAPTM

Electric Double Layer Capacitors

2020

CAT.NO.E1009H



Contents

- 2 Introduction of Electric Double Layer Capacitor
- 4 DLCAP™ DKA series
- 6 DLCAP™ DXF series
- 8 DLCAP™ DXG series
- 10 DLCAP™ DXE series New!
- 12 DLCAP™ Module New!
- 14 Precaution Statement

◆ Environment-friendly products

Nippon Chemi-Con has been taking proactive approaches toward developing and marketing less environmentally-load products in response to the international efforts for reducing hazardous substances and to the regulations. Nippon Chemi-Con had already abolished 4 additional substances, which will be prohibited from July 2017 in accordance with revised RoHS directive (2011/68/EU), by innovating alternative materials of the outer tube.

RoHS2 Compliant : Compliant to the 2011/65/EU and the revisions (2015/863/EU)

ELV Compliant : Compliant to the 2000/53/EC and the revisions (2016/774/EU)

Please contact us for more information about "Halogen-free specification".

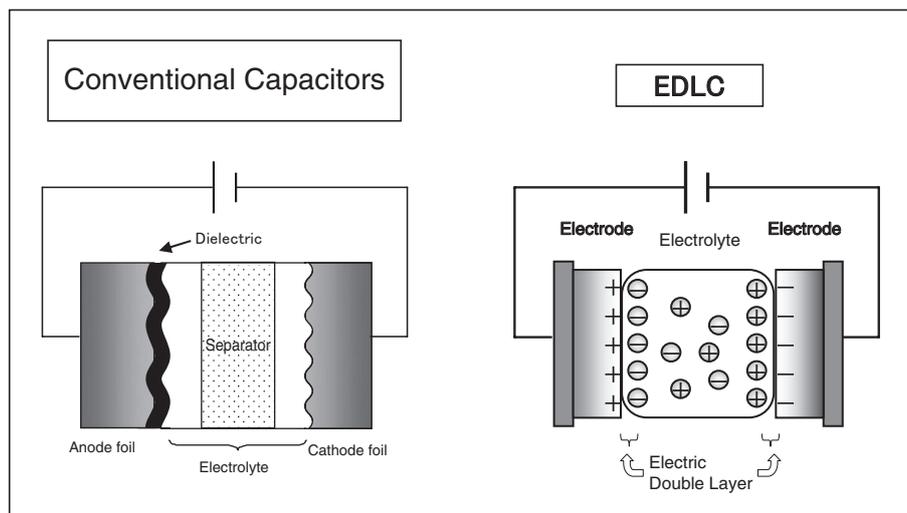
Introduction of Electric Double Layer Capacitor

1. Introduction

Compared to the commonly used rechargeable batteries, Electric Double Layer Capacitor (EDLC), which is capable to be charged-discharged with high current, is an energy storage device which has excellent charge-discharge cycle life. In the recent years, with energy issues (reduction of oil consumption, consumer electric power, CO₂ emission, and effective use of new energy) being focused, using EDLC on more and more new applications is considered. Installation of EDLC in hybrid or fuel-cell vehicle is also considered. Nippon Chemi-Con has been strongly pursuing products that serve for energy conservation, low environmental load. EDLC represents those environmental-friendly products. We have a wide range of products to meet customers' needs, from dozens to thousands of farads.

2. Basic Mechanism of EDLC

Conventional capacitors have a dielectric sandwiched between two electrodes. When voltage is applied, dipoles are oriented, and thus electric charge is stored. Electric double layer capacitors have electric charges oriented at the boundary of electrolyte and electrodes which is called the "electric double layer."



(Figure1) Mechanism

3. Characteristics

Unlike rechargeable batteries, EDLC does not use chemical reactions and it stores energy solely by physical movement of ion to the surface of activated carbon. That gives EDLC features as following;

- With low degradation, it withstands multimillion charge-discharge cycles.
- With the high power density, rapid (high current) charge-discharge is possible.
- With a high charge-discharge efficiency, the output efficiency of over 95% with a power density 1kW/kg is achieved.
- Environment-friendly without containing heavy metals.
- High in safety at irregular occasions, and will be not destroyed even by short circuiting.

4. Structure

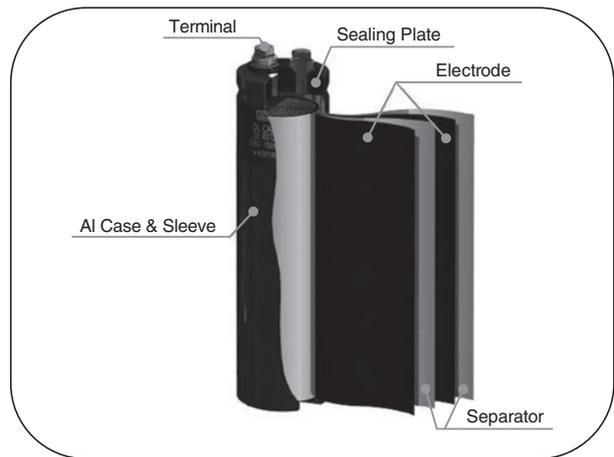
Nippon Chemi-Con produces cylindrical type DLCAP™ (Photo1).

Basic structure is, as shown in figure 2, aluminum foils with electrode pasted on the surface wound into a roll.

Using activated carbon for the electrode utilizing its very large surface area, and with our original high-density electrode manufacturing technology, we achieved both high capacitance and low resistance.



(Photo1) DLCAP™ Appearance



(Figure2) DLCAP™ Structure



ELECTRIC DOUBLE LAYER CAPACITOR

DLCAP™ DKA series



- Increase flexibility of module design.
- Space saving with smaller volume when moduled.
- Very low DCIR even at low and high temperature.

◆ SPECIFICATIONS

Items	Specifications	
Operating Temperature	-40°C ~ +70°C	
Capacitance Tolerance	±10% (K) (25°C)	
Temperature Characteristics	Capacitance Change	≤ ±30% of the measured value at 20°C
	Internal Resistance Change	≤ 600% of the internal resistance maximum value given in the ratings tables (-40°C)
Load Life Test	After the capacitors are subjected to the rated DC voltage at 70°C for 1000 hours, the following specifications shall be satisfied when they are restored to 20°C .	
	Capacitance Change	≤ ±30% of the initial measured value at 20°C
	Internal Resistance Change	≤ 200% of the internal resistance maximum value given in the ratings tables
	After the capacitors are subjected to the rated DC voltage at 60°C for 2000 hours, the following specifications shall be satisfied when they are restored to 20°C .	
	Capacitance Change	≤ ±30% of the initial measured value at 20°C
	Internal Resistance Change	≤ 200% of the internal resistance maximum value given in the ratings tables
Bias Humidity Test	After the capacitors are left at 40°C and 90 to 95%RH for 500 hours, the following specifications shall be satisfied when they are restored to 20°C .	
	Capacitance Change	≤ ±30% of the initial measured value at 20°C
	Internal Resistance Change	≤ 200% of the internal resistance maximum value given in the ratings tables

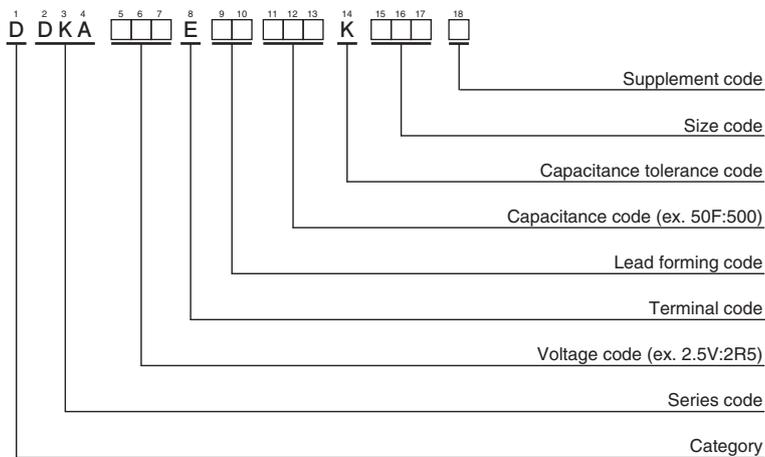
◆ STANDARD RATINGS

● DKA series

Rated Voltage [V]	Capacitance	Nominal Case Size		Internal Resistance		Weight*1 [g]	Energy Storage [Wh]	Part No.
	Typ. (rated) [F]	φ D [mm]	L [mm]	Typ. [mΩ]	Max. [mΩ]			
2.5	50	18	50	11.0	13.2	18	0.04	DDKA2R5ELL500KM50S

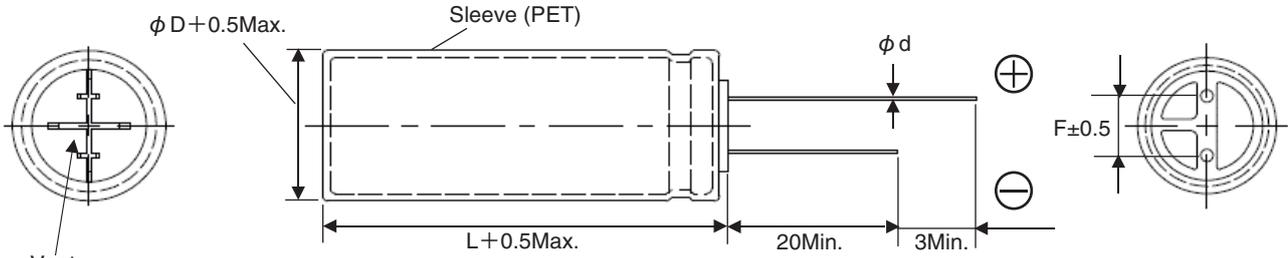
* 1 Reference data

◆ PART NUMBERING SYSTEM



DLCAP™ DKA series

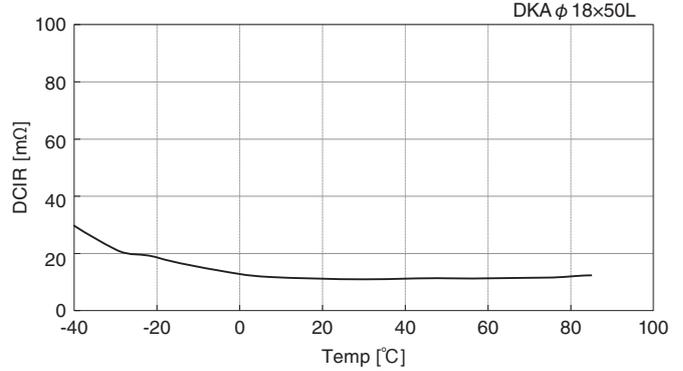
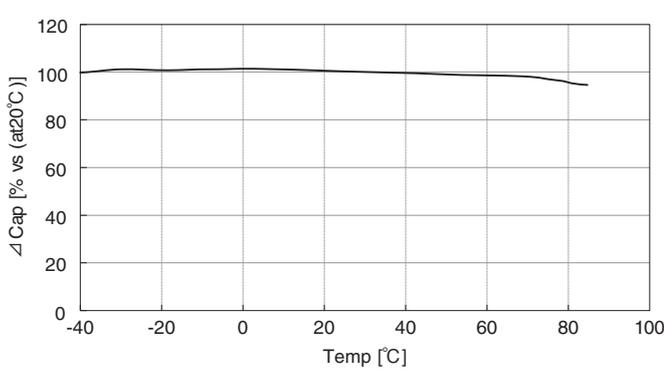
◆ DIMENSIONS [mm]



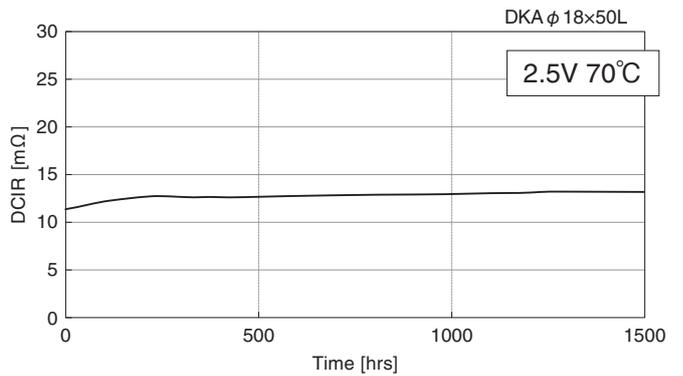
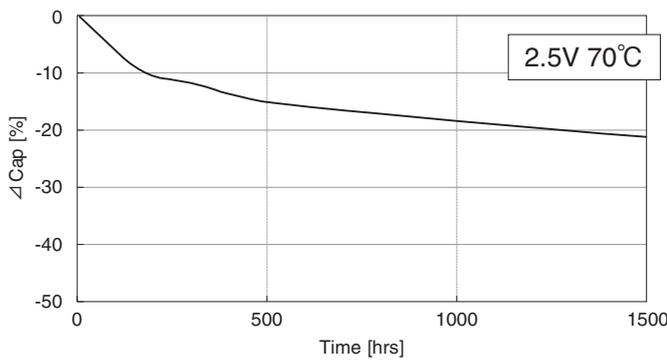
Do not use sealing rubber's orientation of this drawing to identify polarity of the actual part.
Orientation of sealing rubber and safety vent are not associated.

Part No.	ϕD [mm]	L [mm]	F [mm]	ϕd [mm]
DDKA2R5ELL500KM50S	18	50	7.5	0.8

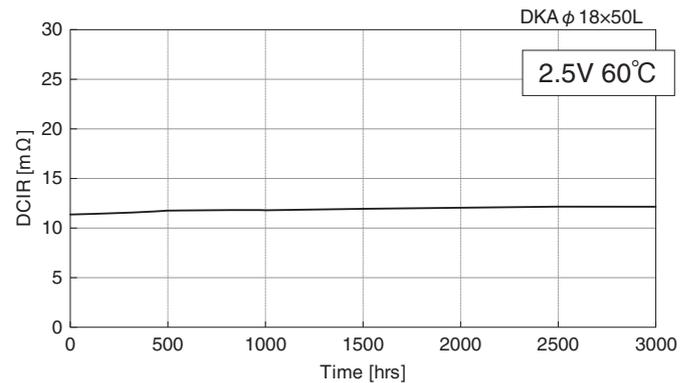
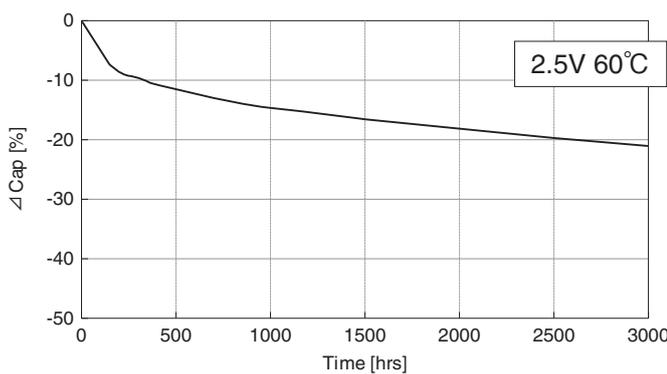
◆ Temperature Dependence of Capacitance & DCIR



◆ 70°C Load Life Test



◆ 60°C Load Life Test



DLCAP™ DXF series



- High withstand voltage 2.8 V achieved.
- Suitable for electricity storage, battery assistance, short-term backups, etc.
- It can be used at 3.0 V (-40°C~+50°C) by temperature delay.

◆ SPECIFICATIONS

Items	Specifications	
Operating Temperature	-40°C ~ +60°C	
Capacitance Tolerance	-0%, +20% (E) (20°C)	
Temperature Characteristics	Capacitance Change	≤ ±30% of the measured value at 20°C
	Internal Resistance Change	≤ 1000% of the internal resistance maximum value given in the ratings tables (-40°C)
Load Life Test	After the capacitors are subjected to the rated DC voltage at 85°C for 1500 hours, the following specifications shall be satisfied when they are restored to 20°C .	
	Capacitance Change	≤ ±30% of the capacitance rated value given in the ratings tables
	Internal Resistance Change	≤ 300% of the internal resistance maximum value given in the ratings tables
Bias Humidity Test	After the capacitors are left at 40°C and 90 to 95%RH for 500 hours, without voltage applied, the following specifications shall be satisfied when they are restored to 20°C .	
	Capacitance Change	≤ ±30% of the capacitance rated value given in the ratings tables
	Internal Resistance Change	≤ 300% of the internal resistance maximum value given in the ratings tables

◆ STANDARD RATINGS

● DXF series *3

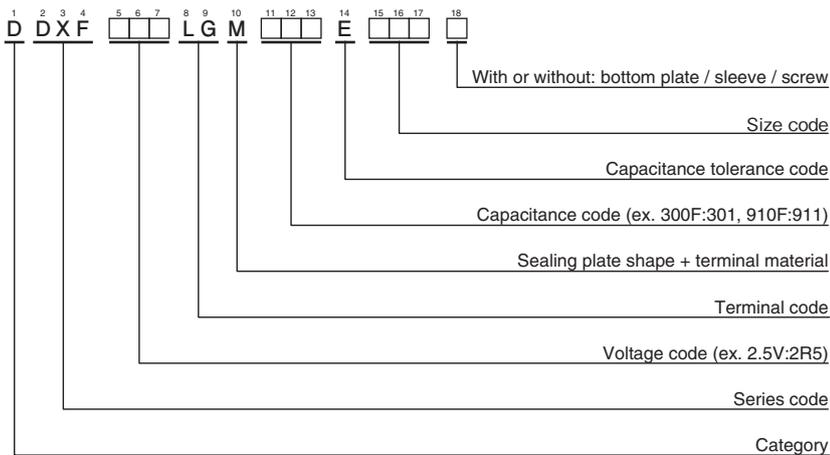
Rated Voltage [V]	Capacitance		Nominal Case Size		Internal Resistance		Weight*1 [g]	Energy Storage*2 [Wh]	Part No.
	Min. (rated) [F]	Typ. [F]	φ D [mm]	L [mm]	Typ. [mΩ]	Max. [mΩ]			
2.8	3150	3500	63.5	172	0.3	0.4	810	3.5	DDXF2R8LGM3B2EDH2S

* 1 Reference data

* 2 The energy storage capacity (Wh) described in this product is calculated based on "Guidebook on Transportation of Electric Double Layer Capacitors for Electrical and Electronic Equipment (JEITA)".

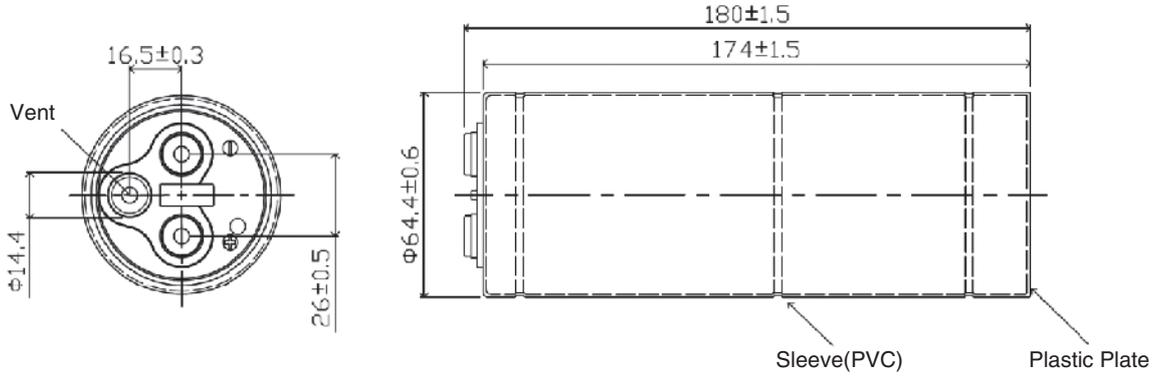
* 3 In the DXF series, the capacity specification are set to the minimum values.

◆ PART NUMBERING SYSTEM

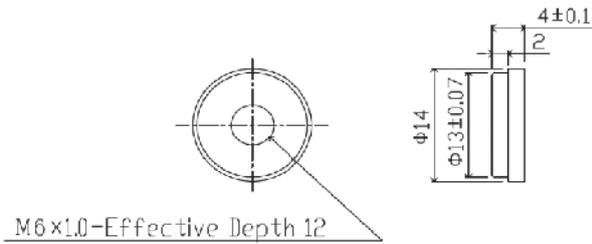


DLCAP™ DXF series

◆ DIMENSIONS [mm]



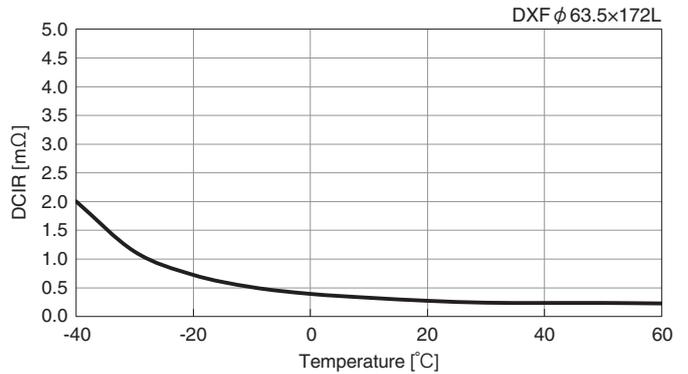
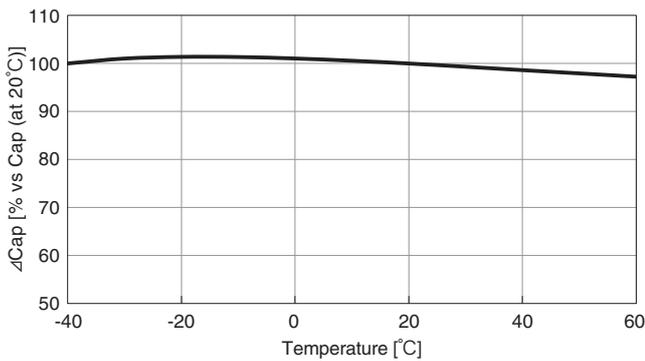
Detailed dimensions of the terminal



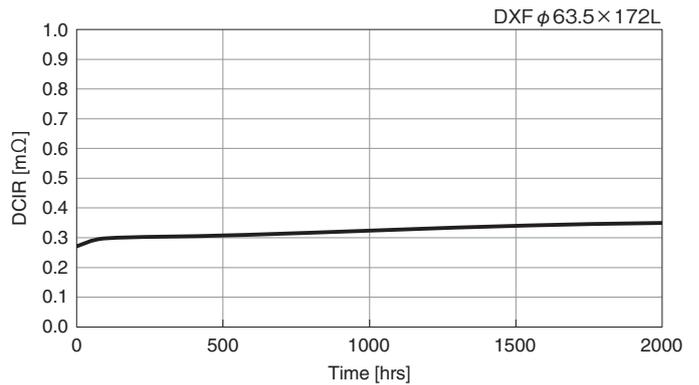
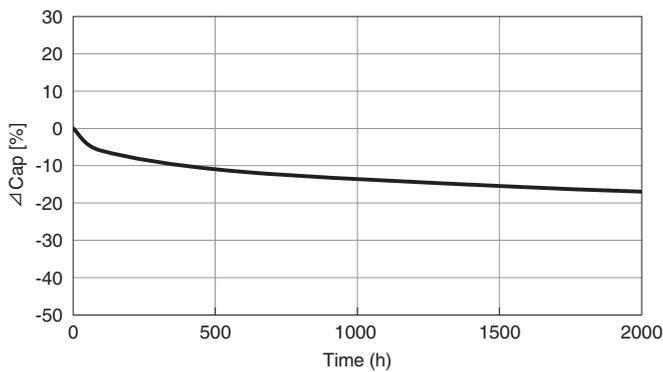
Plus hexagon-headed screw : M6x1.0x12

Maximum screw tightening torque : 5.5Nm

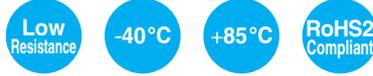
◆ Temperature Characteristics of Capacitance & DCIR



◆ 60°C Load Life Test



DLCAP™ DXG series



- It realizes further higher power density.
- DXG series improves the excellent low temperature characteristics, and it also supports high temperature environment (85°C).
- Suitable for electricity storage, battery assistance, short-term backups, etc.
- Also suitable for kinetic energy recapturing, start/stop, low temperature engine cranking application for automobile.



◆ SPECIFICATIONS

Items	Specifications	
Operating Temperature	-40°C ~ +85°C	
Capacitance Tolerance	-0%, +25% (A) (20°C)	
Temperature Characteristics	Capacitance Change	≤ ±30% of the measured value at 20°C
	Internal Resistance Change	≤ 500% of the internal resistance maximum value given in the ratings tables (-40°C)
Load Life Test	After the capacitors are subjected to the rated DC voltage at 85°C for 1500 hours, the following specifications shall be satisfied when they are restored to 20°C .	
	Capacitance Change	≤ ±30% of the capacitance rated value given in the ratings tables
	Internal Resistance Change	≤ 200% of the internal resistance maximum value given in the ratings tables
	After the capacitors are subjected to the rated DC voltage at 70°C for 3000 hours, the following specifications shall be satisfied when they are restored to 20°C .	
	Capacitance Change	≤ ±30% of the capacitance rated value given in the ratings tables
	Internal Resistance Change	≤ 150% of the internal resistance maximum value given in the ratings tables
Bias Humidity Test	After the capacitors are left at 40°C and 90 to 95%RH for 500 hours without voltage applied, the following specifications shall be satisfied when they are restored to 20°C .	
	Capacitance Change	≤ ±30% of the capacitance rated value given in the ratings tables
	Internal Resistance Change	≤ 200% of the internal resistance maximum value given in the ratings tables

◆ STANDARD RATINGS

● DXG series*3

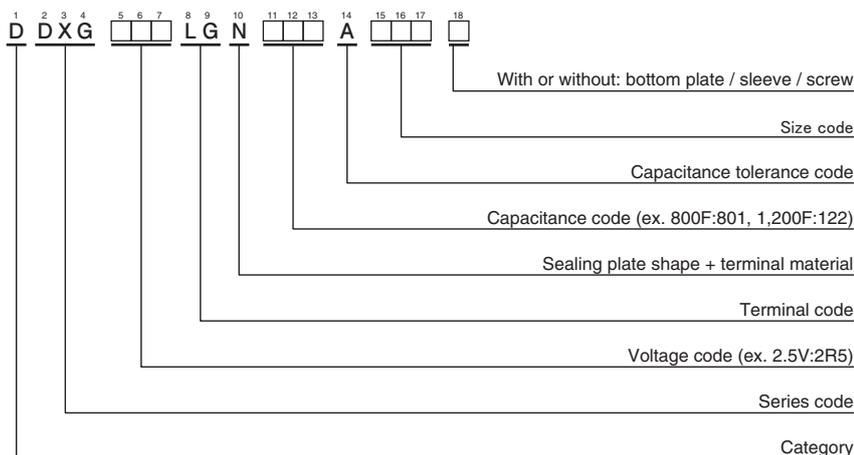
Rated Voltage [V]	Capacitance		Nominal Case Size		Internal Resistance		Weight*1 [g]	Energy Storage*2 [Wh]	Part No.
	Min. (rated) [F]	Typ. [F]	φ D [mm]	L [mm]	Typ. [mΩ]	Max. [mΩ]			
2.5	300	330	40	65	1.2	1.6	120	0.3	DDXG2R5LGN301AB65S
	590	650		105	0.7	1.0	200	0.6	DDXG2R5LGN591ABA5S
	910	1000		150	0.5	0.7	280	0.8	DDXG2R5LGN911ABF0S

* 1 Reference data

* 2 The energy storage capacity (Wh) described in this product is calculated based on "Guidebook on Transportation of Electric Double Layer Capacitors for Electrical and Electronic Equipment (JEITA)".

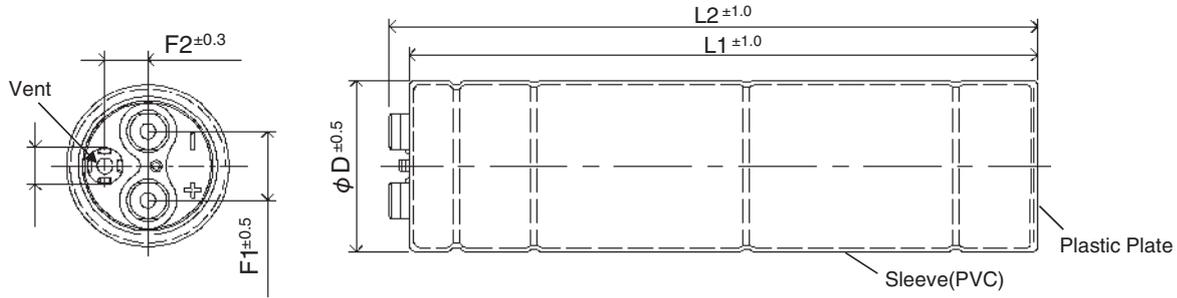
* 3 In the DXG series, the capacity specification are set to the minimum values.

◆ PART NUMBERING SYSTEM



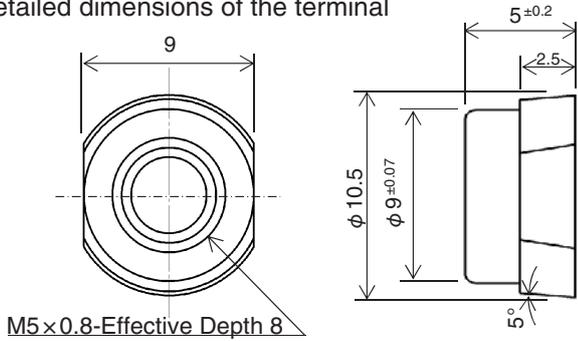
DLCAP™ DXG series

◆ DIMENSIONS [mm]



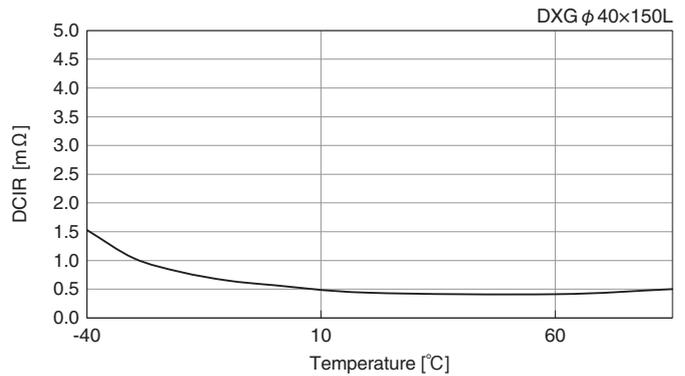
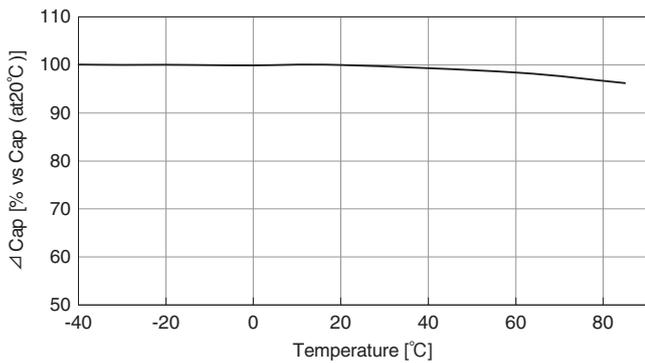
Part No.	φ D [mm]	L 1 [mm]	L 2 [mm]	F1 [mm]	F2 [mm]
DDXG2R5LGN301AB65S	40.4	66	71	17.0	10.5
DDXG2R5LGN591ABA5S		106	111		
DDXG2R5LGN911ABF0S		151	156		

Detailed dimensions of the terminal

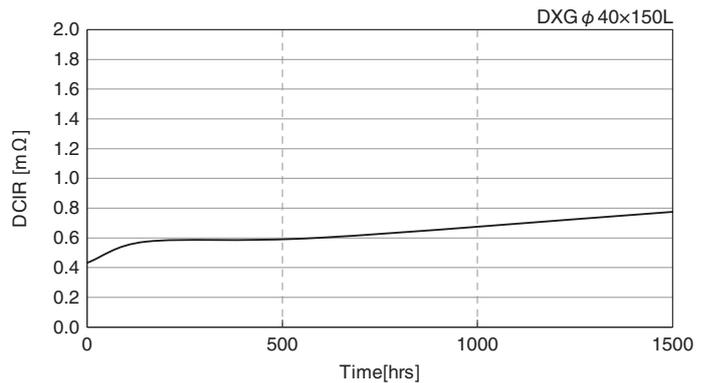
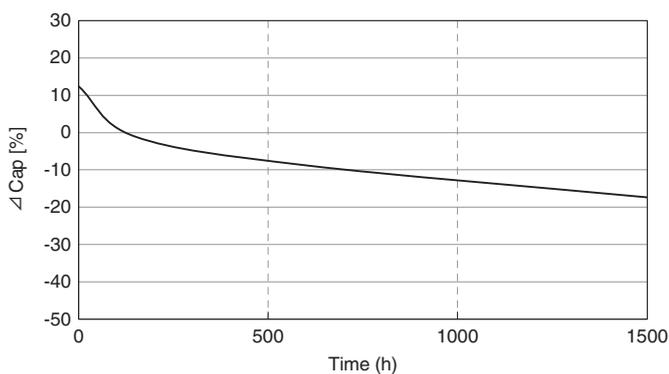


< Screw specification >
 Plus hexagon-headed screw : M5×0.8×10
 Maximum screw tightening torque : 3.23Nm

◆ Temperature Characteristics of Capacitance & DCIR



◆ 85°C Load Life Test





ELECTRIC DOUBLE LAYER CAPACITOR

DLCAP™ DXE series



- Suitable for electricity storage, battery assistance, short-term backups, etc.
- Also suitable for kinetic energy recapturing, start/stop application for automobile.
- Of placing, it's possible to establish.



◆ SPECIFICATIONS

Items	Specifications	
Operating Temperature	-40°C ~ +70°C	
Capacitance Tolerance	±10% (K) (20°C)	
Temperature Characteristics	Capacitance Change	≤ ±30% of the measured value at 20°C
	Internal Resistance Change	≤ 1200% of the internal resistance maximum value given in the ratings tables (-40°C)
Load Life Test	After the capacitors are subjected to the rated DC voltage at 70°C for 2000 hours, the following specifications shall be satisfied when they are restored to 20°C .	
	Capacitance Change	≤ ±30% of the initial measured value at 20°C
Bias Humidity Test	After the capacitors are left at 40°C and 90 to 95%RH for 500 hours without voltage applied, the following specifications shall be satisfied when they are restored to 20°C .	
	Capacitance Change	≤ ±30% of the initial measured value at 20°C
Internal Resistance Change	≤ 300% of the internal resistance maximum value given in the ratings tables	

◆ STANDARD RATINGS

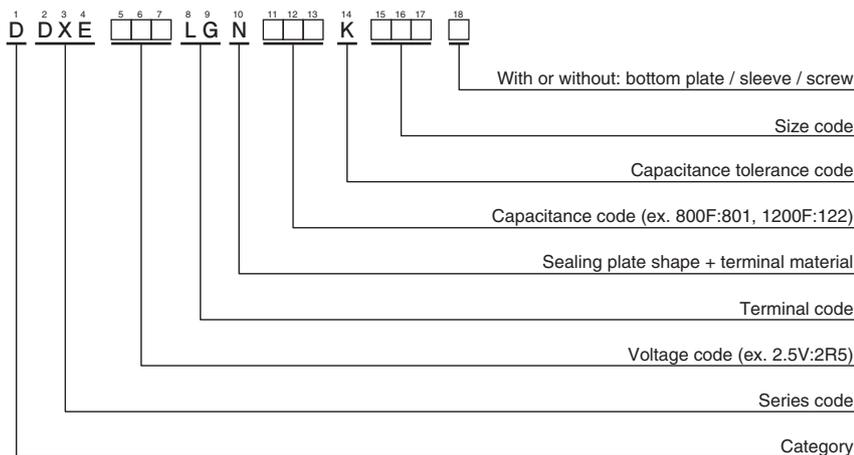
● DXE series

Rated Voltage [V]	Capacitance		Nominal Case Size		Internal Resistance		Weight* ¹ [g]	Energy Storage* ² [Wh]	Part No.
	Typ. (rated) [F]	Min. [F]	φ D[mm]	L[mm]	Typ. [mΩ]	Max. [mΩ]			
2.5	400	360	40	65	2.1	2.5	120	0.4	DDXE2R5LGN401KB65S
	800	720		105	1.1	1.3	200	0.7	DDXE2R5LGN801KBA5S
	1200	1080		150	0.8	1.0	280	1.1	DDXE2R5LGN122KBF0S
	1400	1260		150	1.1	1.3	280	1.3	DDXE2R5LGN142KBF0S
Rated Voltage [V]	Capacitance		Nominal Case Size		Internal Resistance		Weight* ¹ [g]	Energy Storage* ² [Wh]	Part No.
	Typ. (rated) [F]	Min. [F]	φ D[mm]	L[mm]	Typ. [mΩ]	Max. [mΩ]			
2.5	400	360	40	65	2.1	2.5	120	0.4	DDXE2R5LGL401KB65S* ³
	1400	1260		150	1.1	1.3	280	1.3	DDXE2R5LGL142KBF0S* ³

New!

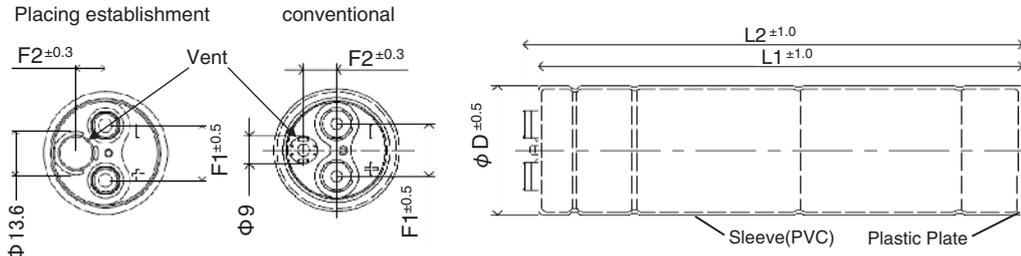
- * 1 Reference data
- * 2 The energy storage capacity (Wh) described in this product is calculated based on "Guidebook on Transportation of Electric Double Layer Capacitors for Electrical and Electronic Equipment (JEITA)".
- * 3 Possible to used horizontally

◆ PART NUMBERING SYSTEM



DLCAP™ DXE series

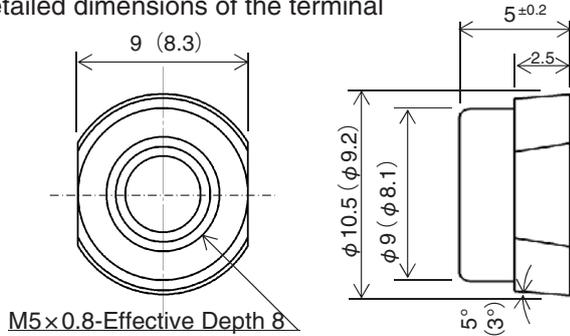
◆ DIMENSIONS [mm]



Part No.	φ D [mm]	L 1 [mm]	L 2 [mm]	F 1 [mm]	F 2 [mm]
DDXE2R5LGN401KB65S	40.4	66	71	17.0	10.5
DDXE2R5LGN801KBA5S		106	111		
DDXE2R5LGN122KBF0S		151	156		
DDXE2R5LGN142KBF0S		151	156		
Part No.	φ D [mm]	L 1 [mm]	L 2 [mm]	F 1 [mm]	F 2 [mm]
DDXE2R5LGL401KB65S *3	40.4	66	71	17	9
DDXE2R5LGL142KBF0S *3		151	156		

New!

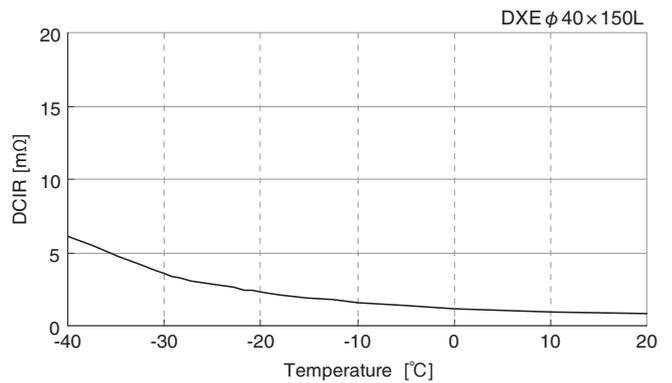
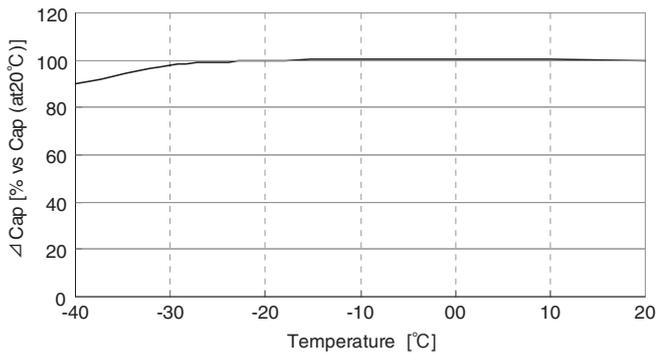
Detailed dimensions of the terminal



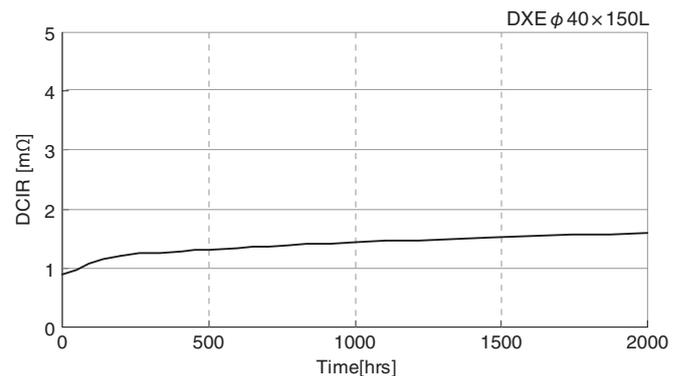
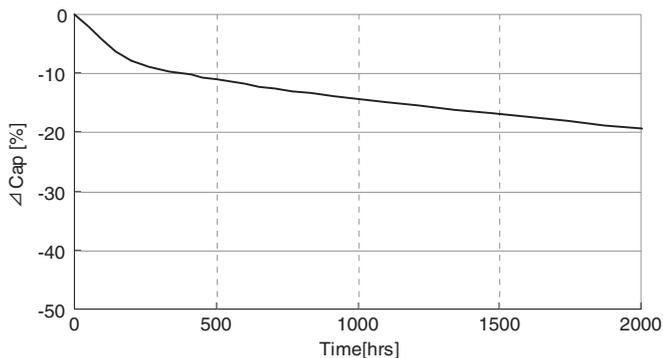
< Screw specification >

Plus hexagon-headed screw : M5 × 0.8 × 10
Maximum screw tightening torque : 3.23Nm

◆ Temperature Characteristics of Capacitance & DCIR



◆ 70°C Load Life Test



New!

DLCAP™ Module (Horizontal installation compatible)

Horizontal
installation
compatible

Low
Resistance

+70°C

RoHS2
Compliant

For an easy usage of Electric Double Layer Capacitor DLCAP™, we have prepared modules (horizontal installation compatible). By connecting multiple modules according to custom requirements, modules with higher voltage and larger capacitance can be made. Improved space efficiency for vertical multiple connections compared to our conventional products. (please refer 'Features of connection')

● Application Examples

◆ Energy Saving

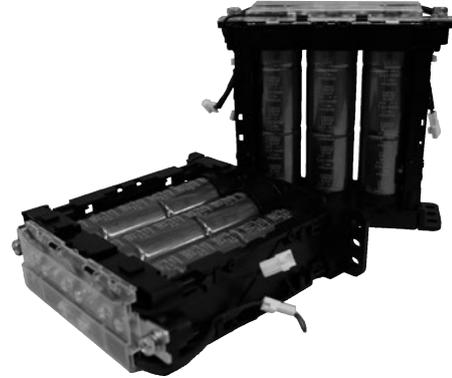
- Peak power assistance
- Effective recapture of kinetic energy

◆ Renewable Energy

- Stabilization of windmill power
- High efficient charge of solar energy
- Electricity assist for fuel cell

◆ Safety & Emergency Applications

- Momentary large power supply at power failure
- Back up for power source failure



● DLCAP™ Module

◆ FEATURES

- Voltage balance circuit installed
- Over voltage detection circuit installed
- Thermistor for temperature monitor installed

◆ SPECIFICATIONS

Items	Specifications	
Operating Temperature	-40°C ~ +70°C	
Capacitance Tolerance	+10%/-15% (20°C)	
Temperature Characteristics	Capacitance Change	≤ ±30% of the measured value at 20°C
	Internal Resistance Change	≤ 1200% of the internal resistance maximum value given in the ratings tables (-40°C)
Load Life Test	After the capacitors are subjected to the rated DC voltage at 70°C for 2000 hours, the following specifications shall be satisfied when they are restored to 20°C .	
	Capacitance Change	≤ ±30% of the initial measured value at 20°C
	Internal Resistance Change	≤ 300% of the internal resistance maximum value given in the ratings tables
Bias Humidity Test	After the capacitors are left at 40°C and 90 to 95%RH for 500 hours without voltage applied, the following specifications shall be satisfied when they are restored to 20°C .	
	Capacitance Change	≤ ±30% of the initial measured value at 20°C
	Internal Resistance Change	≤ 300% of the internal resistance maximum value given in the ratings tables
Insulation Resistance	The measured value between the lumped terminal and the case using 500Vdc insulation resistance meter shall be more than 100MΩ.	
Insulation Withstand Voltage	No abnormality after the AC 2500V is applied between lumped terminal and package for 1 minute. package for 1 minute.	

◆ STANDARD RATINGS

Rated Voltage [V]	Capacitance		Case Size*2			Internal Resistance		Weight*1 [kg]	Energy Storage [Wh]	Part No.
	Typ. (rated) [F]	Min. [F]	D(H) [mm]	W [mm]	H(D) [mm]	Typ. [mΩ]	Max. [mΩ]			
7.5	466	396	54	186	173	3.6	4.2	1.2	3.7	MDXE7R5S461PB3111B

* 1 Reference data

* 2 (Horizontal)

● DLCAP™ Custom Module Acceptable

Customized specifications can be designed upon request.

◆ Custom design examples;

- High voltage application
- Large capacitance application
- High current application
- Proper balance circuit suggestion
- Usage under vibration or physical shocks
- Optional circuits for charge discharge control

Please consult us for other special specifications.

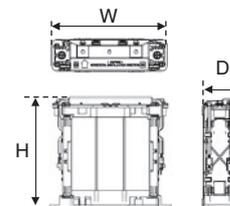
- If you need to connect more than 8 items in series please consult us.

◆ Screw Specification

Screw : M6

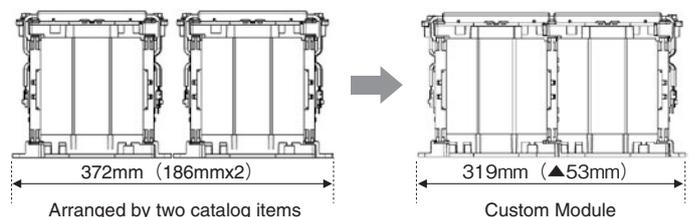
Tightening torque : 5.2Nm±10%

◆ DIMENSIONS



★ Features of connection
Downsizing when connected vertically (Custom Module)

e.g.



DLCAP™ Module



For an easy usage of Electric Double Layer Capacitor DLCAP™, we have prepared modules. By connecting multiple modules, modules with higher voltage and larger capacitance can be made.

● Application Examples

◆ Energy Saving

- Peak power assistance
- Effective recapture of kinetic energy

◆ Renewable Energy

- Stabilization of windmill power
- High efficient charge of solar energy
- Electricity assist for fuel cell

◆ Safety & Emergency Applications

- Momentary large power supply at power failure
- Back up for power source failure



● DLCAP™ Module

◆ FEATURES

- Voltage balance circuit installed
- Over voltage detection circuit installed
- Thermistor for temperature monitor installed

◆ SPECIFICATIONS

Items	Specifications	
Operating Temperature	-40°C ~ +70°C	
Capacitance Tolerance	+10%/-15% (20°C)	
Temperature Characteristics	Capacitance Change	≤ ±30% of the measured value at 20°C
	Internal Resistance Change	≤ 1200% of the internal resistance maximum value given in the ratings tables (-30°C)
Load Life Test	After the capacitors are subjected to the rated DC voltage at 70°C for 2000 hours, the following specifications shall be satisfied when they are restored to 20°C .	
	Capacitance Change	≤ ±30% of the initial measured value at 20°C
	Internal Resistance Change	≤ 300% of the internal resistance maximum value given in the ratings tables
Bias Humidity Test	After the capacitors are left at 40°C and 90 to 95%RH for 500 hours without voltage applied, the following specifications shall be satisfied when they are restored to 20°C .	
	Capacitance Change	≤ ±30% of the initial measured value at 20°C
	Internal Resistance Change	≤ 300% of the internal resistance maximum value given in the ratings tables
Insulation Resistance	The measured value between the lumped terminal and the case using 500Vdc insulation resistance meter shall be more than 100MΩ.	
Insulation Withstand Voltage	No abnormality after the AC 2500V is applied between lumped terminal and package for 1 minute. package for 1 minute.	

◆ STANDARD RATINGS

Rated Voltage [V]	Capacitance		Case Size			Internal Resistance		Weight* ¹ [kg]	Energy Storage [Wh]	Part No.
	Typ. (rated) [F]	Min. [F]	D [mm]	W [mm]	H [mm]	Typ. [mΩ]	Max. [mΩ]			
7.5	133	113	54	180	97	6.6	7.8	0.7	1.1	MDXE7R5S131SB3111A
	400	340			182	2.7	3.3	1.2	3.2	MDXE7R5S401PB3111A
	466	396			182	3.6	4.2	1.2	3.7	MDXE7R5S461PB3111A

* 1 Reference data

● DLCAP™ Custom Module Acceptable

Customized specifications can be designed upon request.

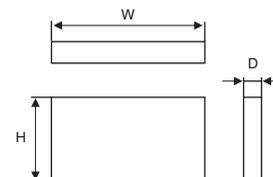
◆ Custom design examples;

- High voltage application
- Large capacitance application
- High current application
- Proper balance circuit suggestion
- Usage under vibration or physical shocks
- Optional circuits for charge discharge control

Please consult us for other special specifications.

- If you need to connect more than 8 items in series please consult us.

◆ DIMENSIONS



◆ Screw Specification

Screw : M6
Tightening torque : 5.2Nm±10%

Precaution Statement

The circuits described as examples in this catalog and the "delivery specifications" are featured in order to show the operations and usage of our products, however, this fact does not guarantee that the circuits are available to function in your equipment systems.

We are not in any case responsible for any failures or damage caused by the use of information contained herein.

You should examine our products, of which the characteristics are described in the "delivery specifications" and other documents, and determine whether or not our products suit your requirements according to the specifications of your equipment systems. Therefore, you bear final responsibility regarding the use of our products.

Please make sure that you take appropriate safety measures such as use of redundant design and malfunction prevention measures in order to prevent fatal accidents and/or fires in the event any of our products malfunction.

1. Precautions in use

① Please do not use the capacitor under the environment, which exceeds the rated performance range.

- a) High temperature (over operating temperature)
- b) Over voltage (over rated voltage)
- c) Application of reverse or alternate voltage

② The outer sleeve and resin plate of the EDLC does not assure electrical insulation.

③ EDLC has finite and regulated life.

④ Please do not use or store EDLC under the following environment;

- a) Environment where the capacitor could be exposed to water, salt water or oil, or the environment which is filled with gaseous oil or salt.
- b) Environment which is filled with toxic gases such as hydrogen sulfide, sulfurous acid, chlorine, ammonia, bromine, or methyl bromide.
- c) Environment where the capacitor could be exposed to acidic or alkaline solvent.
- d) Environment where the capacitor could be exposed to direct sunlight, ozone, ultraviolet rays or radiation.
- e) Environment under extreme vibration or mechanical impact.

⑤ Please note the followings when designing;

- a) EDLC screw terminal When using cells and modules, be sure to install the terminal with the terminal facing upward except for horizontal products.
 - horizontal product.
 - Do not mount EDLC with terminals facing downward or sideways as the electrolyte inside the EDLC may block pressure relief vent and cause it to open, electrolyte to leak, and shorten lifetime.
 - Please set the valve is on the upper side when used horizontally.



Figure. Installation of horizontal products

- b) Please keep the sealing plate facing upward whenever handling EDLC.
 - Facing it downward even for a brief time may shorten lifetime.
- c) Please provide enough clearance space over the pressure relief vent.
- d) Please do not locate any wire or circuit pattern over the pressure relief vent or between the anode and cathode terminal of EDLC.
- e) Please avoid locating any heat source components near EDLC.
- f) To assure insulation voltage, please provide adequate space among EDLC case, cathode terminal, anode terminal, circuit pattern and chassis.
- g) Please note that electrical properties of EDLC may change according to the changes in temperature and frequency of EDLC.
- h) When the temperature between EDLC cells in a same system differs largely, it may amplify the slight characteristic difference of each cell, and may cause the system to malfunction in the end.
 - Please make sure to design the system with an adequate heat radiation to avoid variation in temperature among the cells.

- i)When heat increase is expected due to charging and discharging of EDLC, please conduct a load test to confirm there is no abnormal heat rise, and the temperature stays within the EDLC's specified temperature range.
 - j)Please assure appropriate current balance when connecting two or more EDLC in parallel.
 - k)Please assure appropriate voltage balance when connecting two or more EDLC in series.
 - l)In case of use outside of specification, such as overvoltage and/or above specified temperature range, the electrolyte fume from inside may expelled through releasing valve. Please take that in consideration at the time of system design.
 - m)Please establish safety design such as stopping charge/discharge in case of abnormal temperature and voltage. Applying voltage that exceeds rated voltage frequently may cause the devices to smoke or burn.
Please design the system with fail-safe functions.
 - n)As EDLC has internal resistance, the internal heat generated by charge-discharge affects its life.
Please choose the products with low resistance and make sure to avoid overheat of the capacitor.
 - o)Due to capacitor's internal resistance, there is a voltage drop (also referred to as "IR drop") at the beginning of charge-discharge. Please consider this voltage drop in your circuit design.
- ⑥ When a capacitor is fully charged, short-circuiting the output terminals could cause the electric current to flow as high as a few hundred amperes. Please do not install or uninstall a module when it is charged.
- ⑦ Please do not drop EDLC. Do not use it once it is dropped.
- ⑧ Please make sure of the polarity when assembling EDLC into a module.
- ⑨ Please follow the specification of the screw tightening torque.
- ⑩ Please do not deform EDLC when assembling it into a module.
- ⑪ Voltage of EDLC changes in proportion to the stored energy.
If stable output voltage is required, circuit system such as converter needs to be added.
- ⑫ When using EDLC for industrial application, following periodical check is recommended.
Please disconnect power from the device and fully discharge EDLC before conducting periodical check.
- a)Appearance: Significant damage in appearance including deformation, liquid leakage, discolor, dust between the terminals and stain
 - b)Electrical characteristics: Characteristics prescribed in the catalog or product specifications.
- ⑬ Please stop the whole system when EDLC generates excessive heat or a foul smell.
In case of excessive heat, do not get close to the part in order to avoid injury.
- ⑭ Please stop the system immediately and ventilate the area sufficiently when the pressure relief vent on EDLC operates and releases a gas from inside.
Never expose your face or your hand as hot gas may expel.
If the gas is inhaled or hits eyes, please wash your eyes, gargle, and consult with a doctor immediately.
Do not lick the electrolyte of EDLC. Wash away the electrolyte from the skin with soap and water.
- ⑮ EDLC may have been spontaneously recharged with time by a recovery voltage phenomenon.
Discharge EDLC as necessary especially before connecting multiple EDLCs in series.
- ⑯ Please discharge EDLC before assembling or removing. There is a risk of large current flow and electrical shock when short circuiting the terminal with residual voltage.
Note that EDLC may be self-charged while being left open-circuit even after fully discharged.
- ⑰ Do not wash EDLC.
- ⑱ Do not use any adhesive or coating materials containing halogenated solvents.

2. Precautions in transportation

- ① When exporting EDLC, fumigation process may be required for export in some countries.
Please note that some types of fumigation process which uses halogenated ions may cause corrosion on EDLC materials.
- ② Due to the Export Trade Control Ordinance, the documents obtained to the exporter concerning that export trade, with information that the product is being used for developing mass destruction weapons, the exporter will have to apply and hand in the export permission from the Ministry of Industrial Trade and Industry.
- ③ During transportation of EDLC. Please make sure to place its terminal upward to avoid electrolyte leakage both vertical and horizontal products.
- ④ Transport operations of EDLC has been changed in line with the revision of
"The Recommendations on the Transport of Dangerous Goods" adopted by the United Nations in December 2010.
Please confirm the latest information of the followings as well as laws of each country.
 - United Nations (UN) Recommendations on the Transport of Dangerous Goods-Model Regulations.
 - International Civil Aviation Organization (ICAO) Technical Instructions for the Safe Transport of Dangerous Goods by Air.
 - International Air Transport Association (IATA) Dangerous Goods Regulations.
 - International Maritime Organization (IMO) IMDG (International Maritime Dangerous Goods) -code.

3. Precautions in storage

- ① Please store EDLC at temperature between 5°C~35°C and humidity less than 75% .
Please avoid an environment with drastic temperature change which could damage the product.
- ② Long term storage may cause an increase of leakage current, decrease of capacitance, increase of internal resistance, etc..
Before using the part after a long term storage over 6 months, please charge it with a current of 5mA per Farad, up to the rated voltage, then keep the voltage for around 20 hours.
Please then measure the electric characteristics to ensure the part still has the desired performance.

4. Precautions in disposal

Please discharge the electricity to safety voltage before disposal.
Please follow the laws or regulations at the place of disposal.
Please drill or crash the part before incineration.

Please refer to the following report before using EDLC.

Japan Electronics and Information Technology Industries Association, JEITA RCR-2370B
"Safety Application Guide for electric double layer capacitors (Guideline of notes for electric double layer capacitors)"

Japan Electronics and Information Technology Industries Association
"Guidelines of the transport of fixed electric double-layer capacitors for use in electric and electronic equipment" (Japanese only)

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* Specifications in this catalog are subject to change without notice.